Comments on Proposed Changes to the California Energy Commission's External Power Supply Efficiency Standards

January 30, 2006

Chris Calwell
Policy and Research Director
Ecos Consulting
Presented on behalf of Pacific Gas & Electric

Key Power Supply Questions

1. Should the external power supply standard effectiveness date be delayed beyond July 1, 2006?
2. Should battery charging products currently covered by the external power supply standard be migrated to a new battery standard? If so, should other battery charging products be included as well?
3. Should the 230 volt testing requirement be dropped?
4. Should active mode efficiency levels be reduced for units with an output voltage of less than 15 volts or specific product types like medical be exempted?
5. Should no load power be increased to 1.5 watts for power supplies > 50 watts with power factor correction?
6. Should cordless phone power supplies be exempted due to surge tolerance requirements?

First CEC-Sponsored Technical Workshop on External Power Supply and Battery Charger Test Procedures: November 2003

Invitation to a Technical Workshop on:

The Energy Efficiency of External Power Supplies & Battery Chargers: A Discussion of Test Methods, Efficiency Metrics & Measured Performance

Pacific Energy Center
851 Howard Street
San Francisco, CA

November 7, 2003
8:30 a.m. to 4:00 p.m.

Who should come?

You are invited to attend a technical workshop to discuss ways to measure the energy efficiency and technical performance of single voltage external AC/DC power supplies and consumer battery chargers. This invitation has been extended to companies that make external power supplies and battery chargers and their components, companies that incorporate these devices into their finished products, energy efficiency researchers and advocates, and government officials and regulators. Topics related to external power

Advance Notice of Mandatory Efficiency Standards for External Power Supplies

- Technical workshops with industry in 2002, 2003 & 2004
- Draft test procedure and measured data posted for comment at www.efficientpowersupplies.org since late 2003
- PG&E CASE report with proposed levels and savings analysis posted publicly since early 2004
- Presentations on the topic at Applied Power Electronics Conference (APEC) in 2002, 2004, and 2005; similar presentations to CEA meeting and Consumer Electronics Show in 2003-2004
- Multiple CEC workshops and hearings on external power supplies from late 2003 through late 2004
- Simultaneous outreach by governments to electronic product and power supply manufacturers and component manufacturers in U.S., Europe, China, and Australia from 2003 to 2005, all employing same test procedure, extensive data set, and marking protocols
- CEC grants 6-month extension to external power supplies at 12/04 adoption hearing (7/1/06 effectiveness date instead of 1/1/06 date for other products)
- Similar standards adopted legislatively in 2005 by Arizona, Massachusetts, New York, Oregon, Rhode Island, and Washington

Media Coverage of December 2004 CEC Decision to Adopt External Power Supply Efficiency Standards

Wire Stories

- "California Mandates Energy Efficient TVs, DVDs, Phones, Chargers," *Associated Press*, 12/16/04.
- "California passes first-of-their-kind regs on consumer appliances," *Greenwire*, 12/16/04.
- "California rules raise appliance efficiency," *AFX Asia*, 12/31/04.

Trade Publications

- "California Regulators Force OEMs to Make Energy-Efficient Products," *Appliance Magazine*, February 2005.
- "Power Supply Efficiency Standards – PSMA Goes on Record," *PSMA Update*, First Quarter 2005, 2/14/05.
- "Saving Energy," *Power Management Design Line*, 1/25/05.
- "Power Adapters Could Reduce Electric Usage," *Energy Optimization News*, 1/1/05.

National & Regional Newspapers

- "Put a Plug in It," *Wall Street Journal*, 12/17/04.
- "States act to save energy, ease bills," *USA Today*, 2/2/05.
- "A stake through 'energy vampires:' Agency's Stricter Rules on Electronic Devices Will Reduce Their Constant Power Use," *San Jose Mercury News*, 12/27/04.
- "An Adaptable Plan to Achieve Energy Savings," *Pittsburgh Post-Gazette*, 1/31/05.

TV News

- "California rules raise appliance efficiency," *CBS Marketwatch*, 12/31/04.

Magazines

- "AC power supplies: Keep them from zapping your wallet and the environment," *Consumer Reports*, January 2005.

Power supply manufacturers are the most directly affected by the standards that the CEC adopted. Through their trade association (PSMA), they wrote a letter in support of global efficiency standards in October 2004.

That was 2 months before CEC's adoption and more than 15 months ago.

Power Sources Manufacturers Association

The Multinational Power Electronics Association

To: The manufacturers, regulatory agencies, and other participants and stakeholders in the power supply industry

From: The Energy Committee of the Power Sources Manufacturers Association

Date: October 7, 2004

Re: Position on voluntary and mandatory standards that will regulate the minimum acceptable efficiency of power supplies. Letter PSMA-EC-2004-2

As responsible participants in the global power supply industry, we believe:

- That providing power supplies with improved efficiency is evidence of being a responsible participant in the market.
- That this effort should be a continuous one as technology and cost of content allows.
- That a multi-level efficiency protocol be established in preference to a single level efficiency standard to foster continuous improvement. That a simple single mark be placed on the power supply to identify its level of compliance.
- That there should be one set of efficiency standards applicable globally.
- That all standards should be established based on data that is well documented as to conditions of test and equipment used. That this data has been measured using methods that meet acceptable engineering practice and using equipment that has been certified at least to secondary standards. That all data used within a standard category be uniformly measured.

PSMA fully supports the efficiency initiatives now in progress. These efficiency

June 17, 2003

Ms. Linda Franklin
Nonresidential Buildings Office
Attn: Appliance Efficiency Regulations
California Energy Commission
1516 Ninth Street, MS-26
Sacramento, California 95814

Dear Ms. Franklin:

The Electronic Industries Alliance (EIA), Consumer Electronics Association (CEA), and Telecommunications Industry Association (TIA) would like to submit the following comments based on the proposals discussed at the California Energy Commission's Workshop on Amendments to Appliance Efficiency Regulations. The focus of these comments is on the appropriateness of considering electronics for appliance standards regulation. EIA, CEA, and TIA ((hereinafter referred to as "EIA") recommend that CEC remove from consideration electronics, including battery chargers and external power supplies, for minimum efficiency standards due to a number of factors:

1. Energy consumption is not necessarily synonymous with energy inefficiency;

2. The proposed standards could increase overall energy consumption;

3. Electronics are inherently energy-efficient products and rapid technological advances have driven higher efficiencies;

4. Minimum efficiency standards would have adverse impacts on technology development and innovation;

Manufacturers Have Also Helped Get Out the Word

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Address http://www.powerint.com/greenroom/reg_cec.htm

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California Energy Commission Appliance Efficiency Regulations

Countries: US - State of California only

Type: Mandatory Efficiency Standard

Links: CEC Appliance Efficiency Regulations Rulemaking page

CEC Home Page

On December 15, 2004, the California Energy Commission adopted new mandatory efficiency requirements for external power supplies and consumer audio and video equipment sold in California. The specification includes active-on efficiency requirements, as well as maximum standby and no-load levels.

PRODUCT	MAX STANDBY
External Power Supplies	**Standards for Power Supplies Effective July 1, 2006**

Nameplate Output (W)	*Minimum Efficiency in Active Mode of Operation*
< 1 Watt	0.49 * Nameplate output (value in Watts)
⩾ 1 (W) ⩽ 49 Watts	0.09 * Ln(nameplate output) + 0.49
> 49 Watts	0.84
	Maximum Energy consumption in No-Load Mode
0 to < 10 Watts	0.50 Watts
⩾ 10 < 250 Watts	0.75 Watts
Where Ln (Nameplate output) = Natural Logarithm of the nameplate output expressed in Watts	

Compact Audio Products	*Effective Jan 1, 2007* 2 W in audio standby passive mode for those w/o permanently illuminated clock display, 4 W for those with
Televisions	*Effective Jan 1, 2006*

Search for Regulations

By Agency

By Application

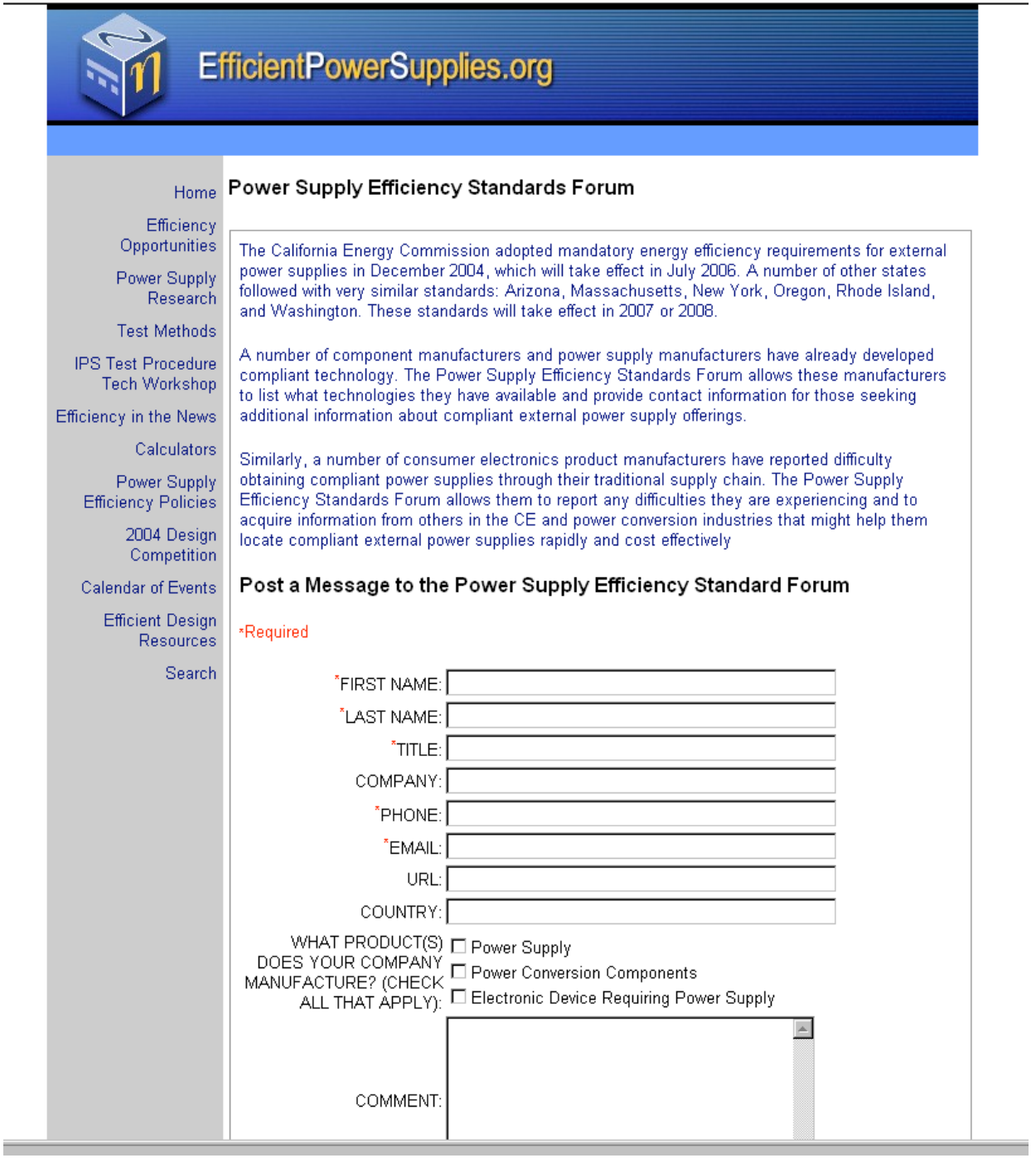
By Location

Design Support

Power Integrations Design Support

View

The California Energy Commission itself has funded an open forum where manufacturers of consumer electronics, power supplies, or components can post information about available solutions or request help locating a qualifying supplier:



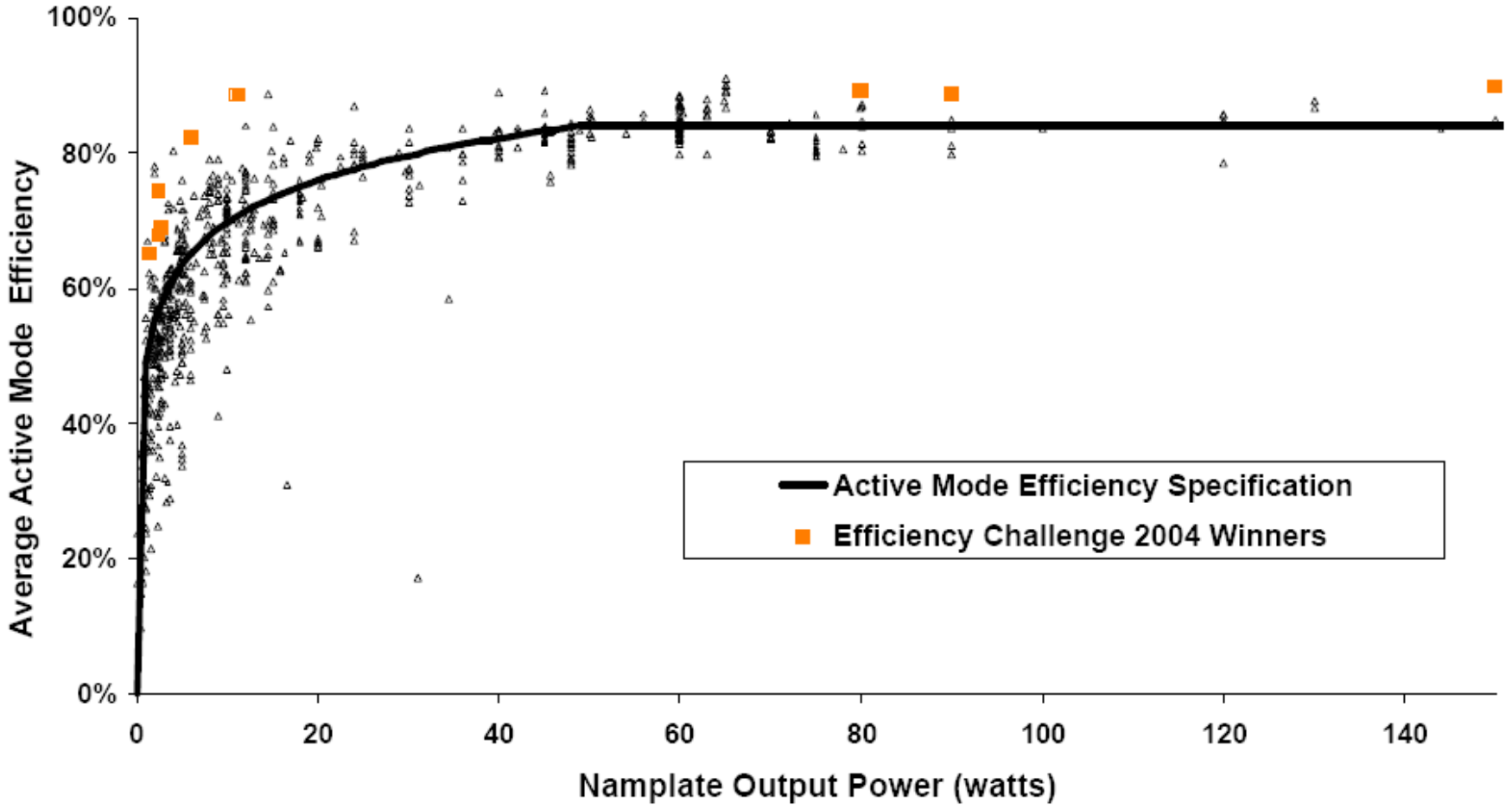
External Power Supplies
Production Units from a Major Manufacturer - 2004

Output		Efficiency (%)		No-Load Input Power (watts)	
Power (watts)	Voltage (volts dc)	Measured (average of 25, 50, 75, 100% of full load)	California Standard, Effective July 1, 2006	Measured	California Standard, Effective July 1, 2006
2	5	77.7	55.2	0.25	0.5
2.2	5	76.6	56.1	0.16	0.5
3	5	71.3	58.9	0.15	0.5
8	12	75.0	67.7	no data	0.5
10	5	74.7	69.7	no data	0.75
12	12	83.7	71.4	no data	0.75
15	5	76.5	73.4	no data	0.75
32	30	85.0	80.2	0.2	0.75
80	32	88.5	84	0.38	0.75

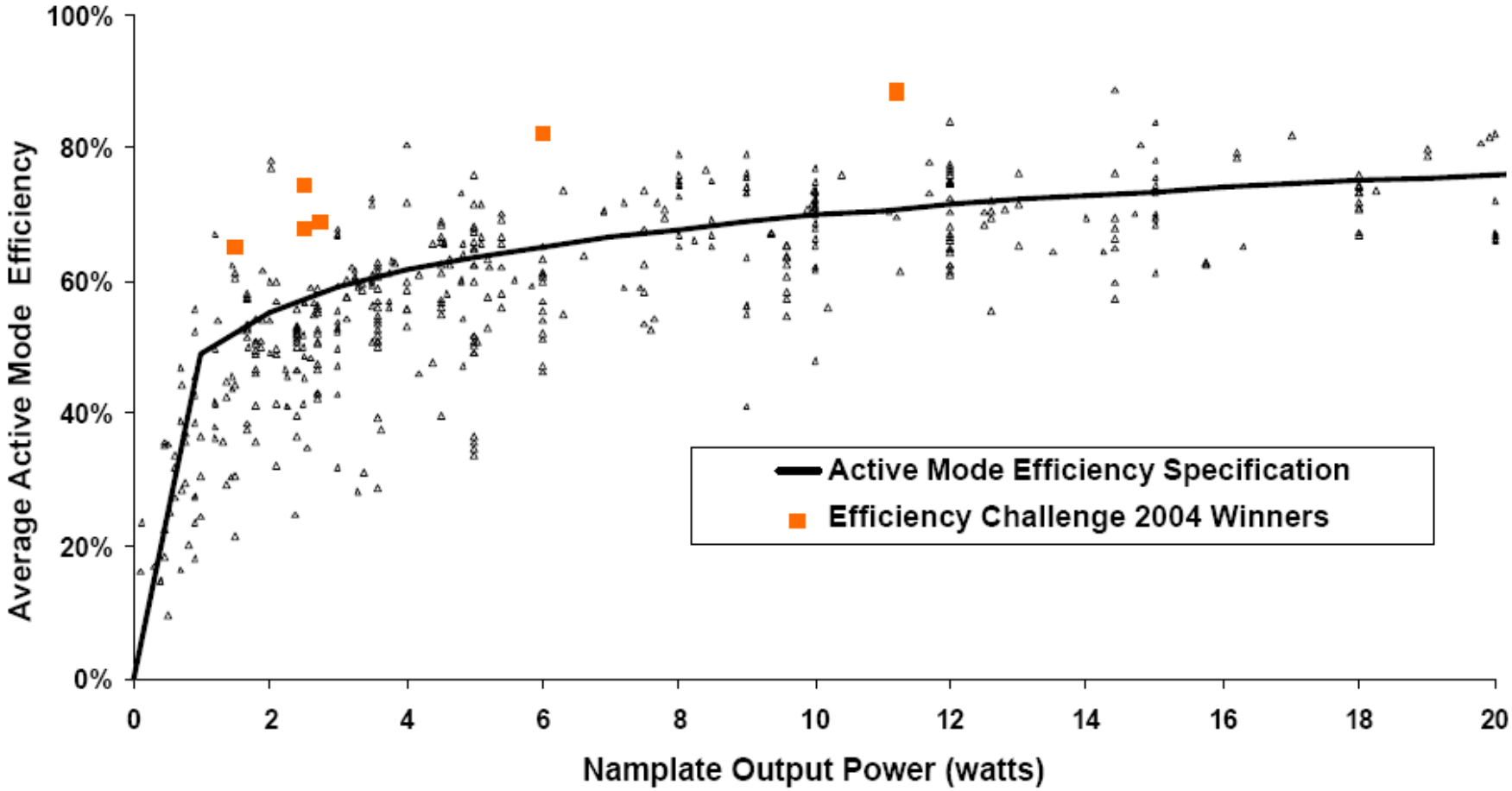
High voltage, low current →

- Sample data from a group of 45 models, 2 watts to 180 watts output, at 5 to 24 Vdc.
- All are universal input (115 – 230 V ac). Data were taken at 115 V ac, 60 Hz.
- All are switched-mode technology, with diode output rectifiers.
- Of the 45 models, only 3 did not pass the 2008 standard.
- These measurements were made in May 2004

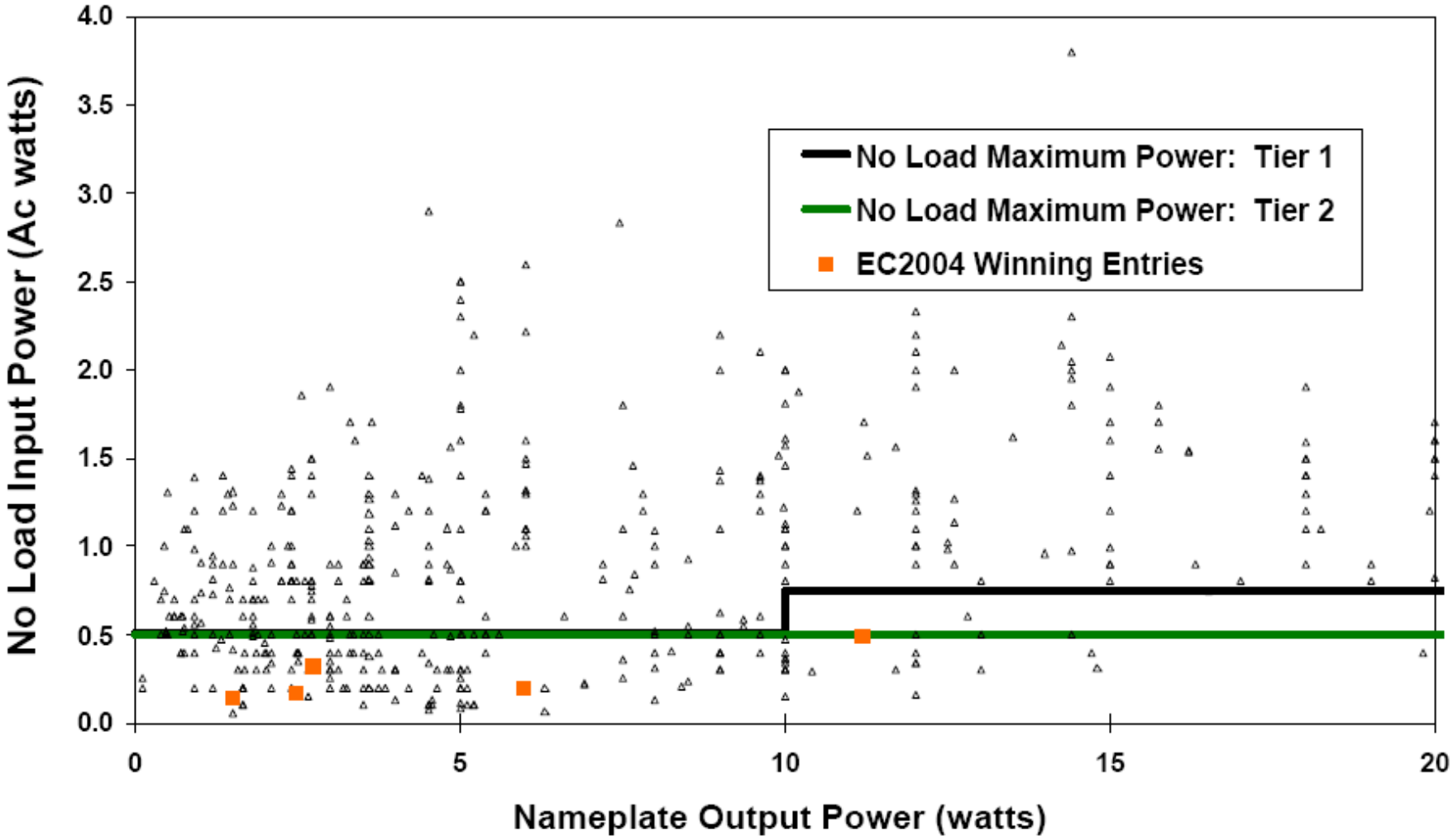
Active Mode Efficiency Results from Efficiency Challenge 2004: A CEC and EPA-Sponsored Power Supply Design Competition



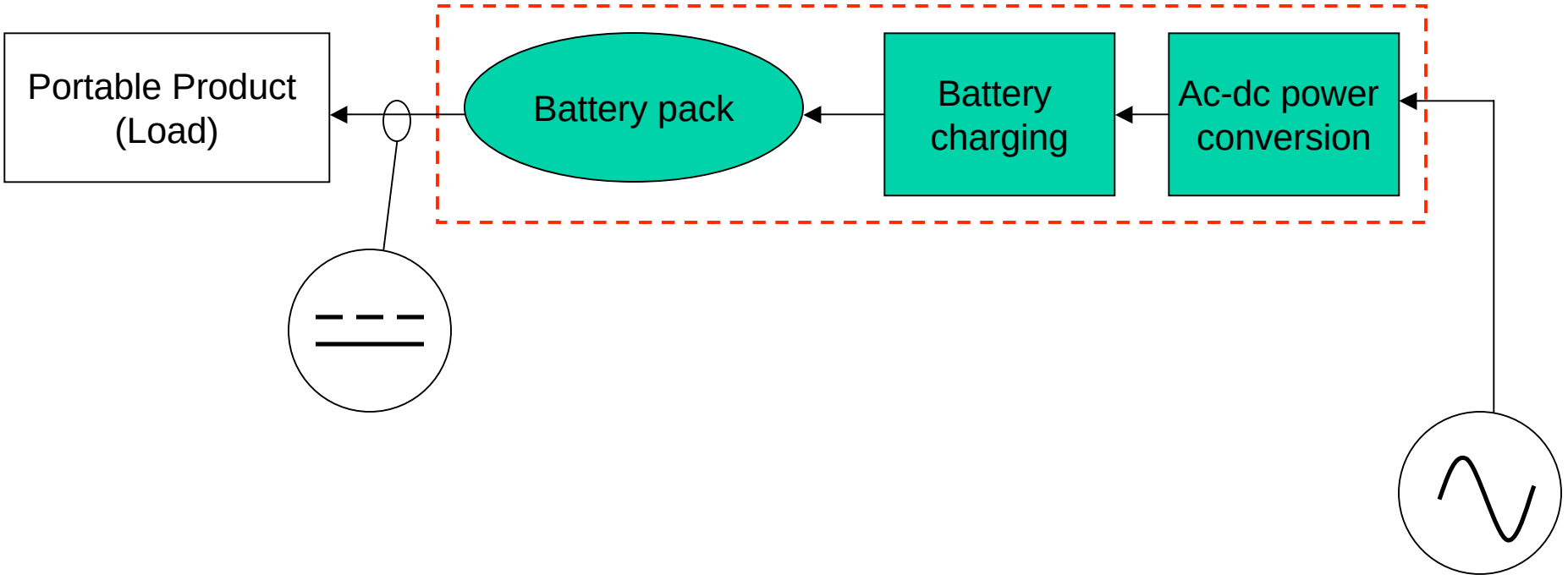
Relative Efficiency of Winners < 20 W



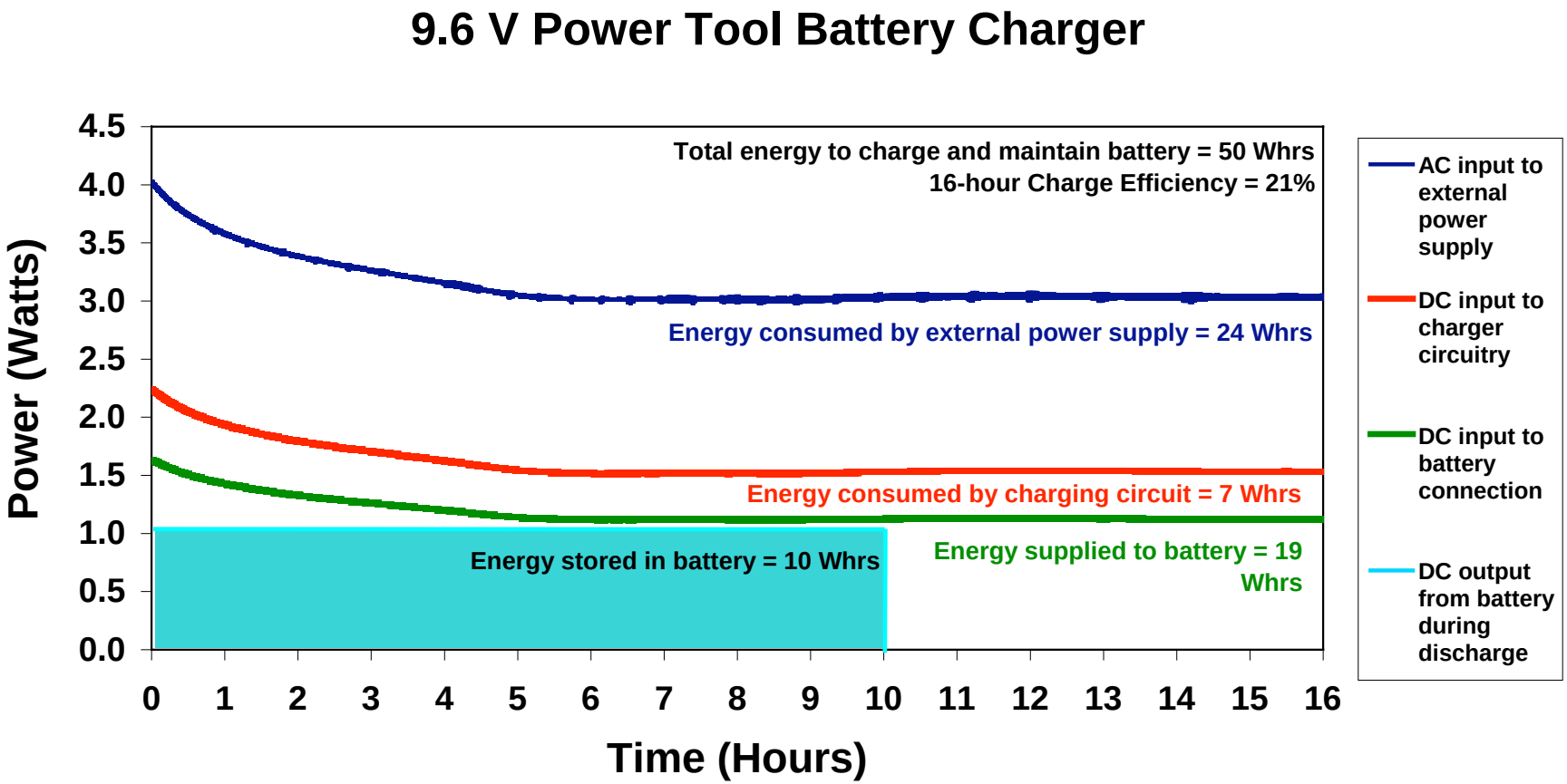
Relative No Load of Winners



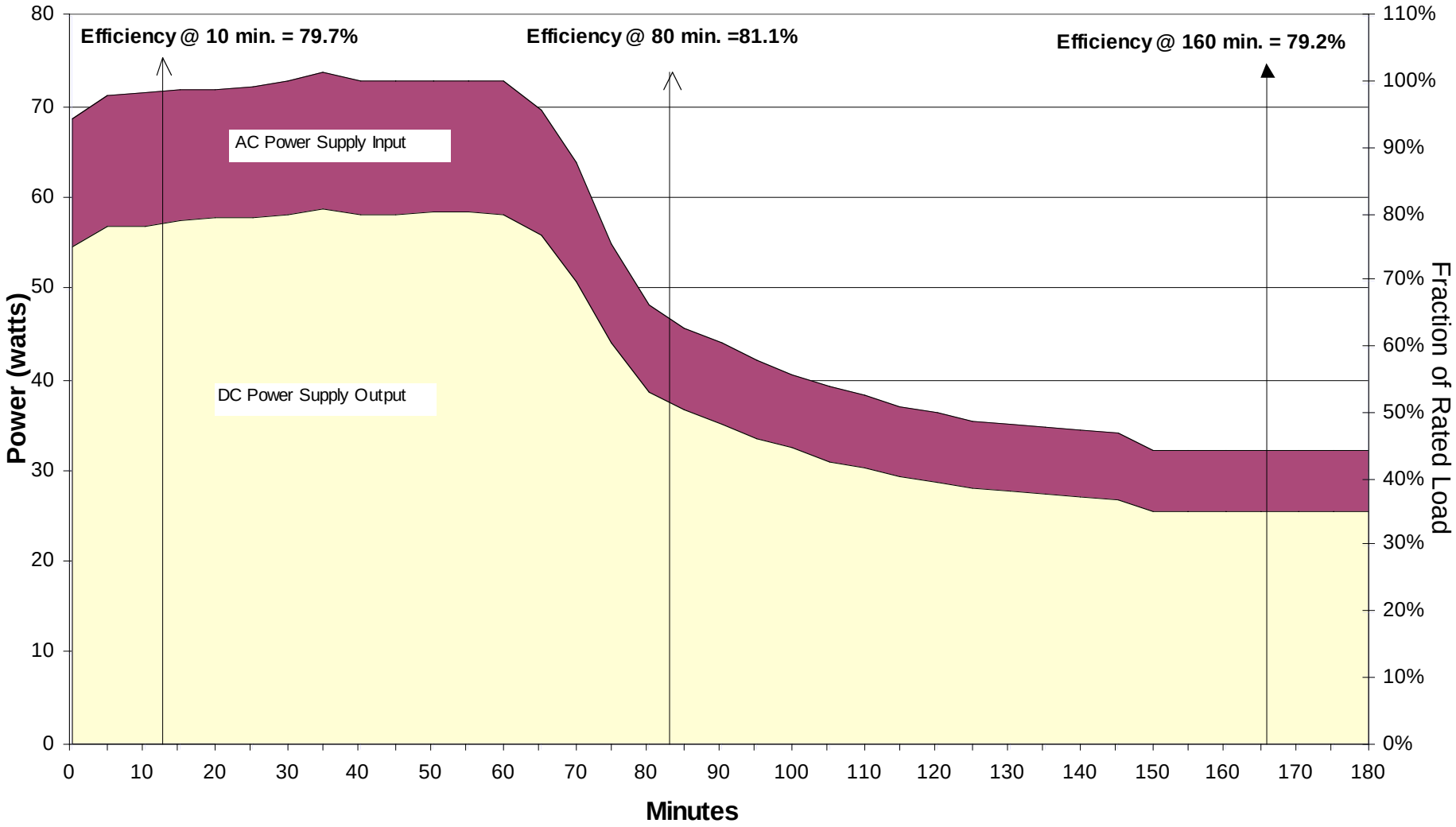
A Battery Charger Contains Three Elements



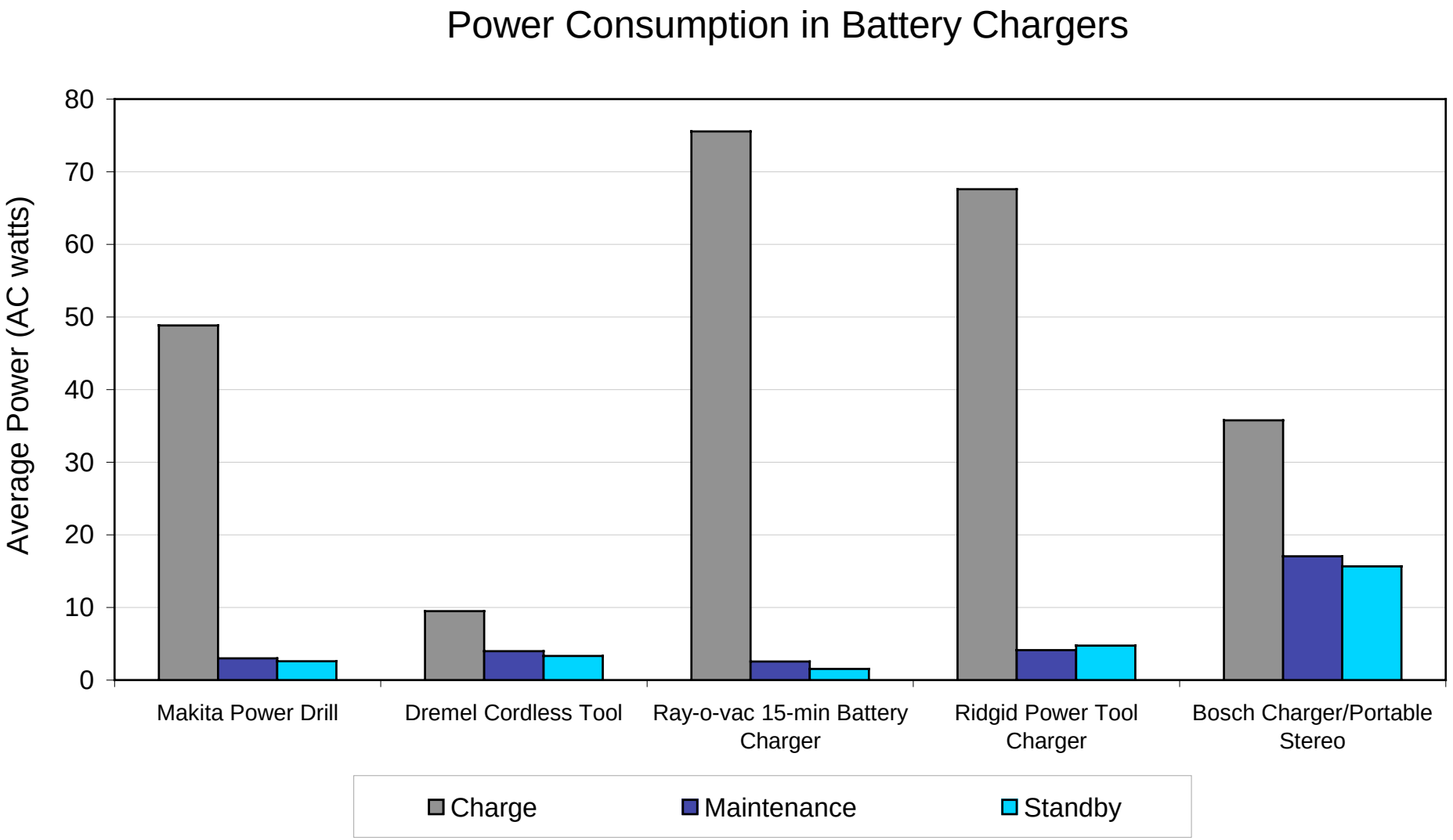
Power Supply Efficiency Is the Cornerstone of Battery Charger Efficiency



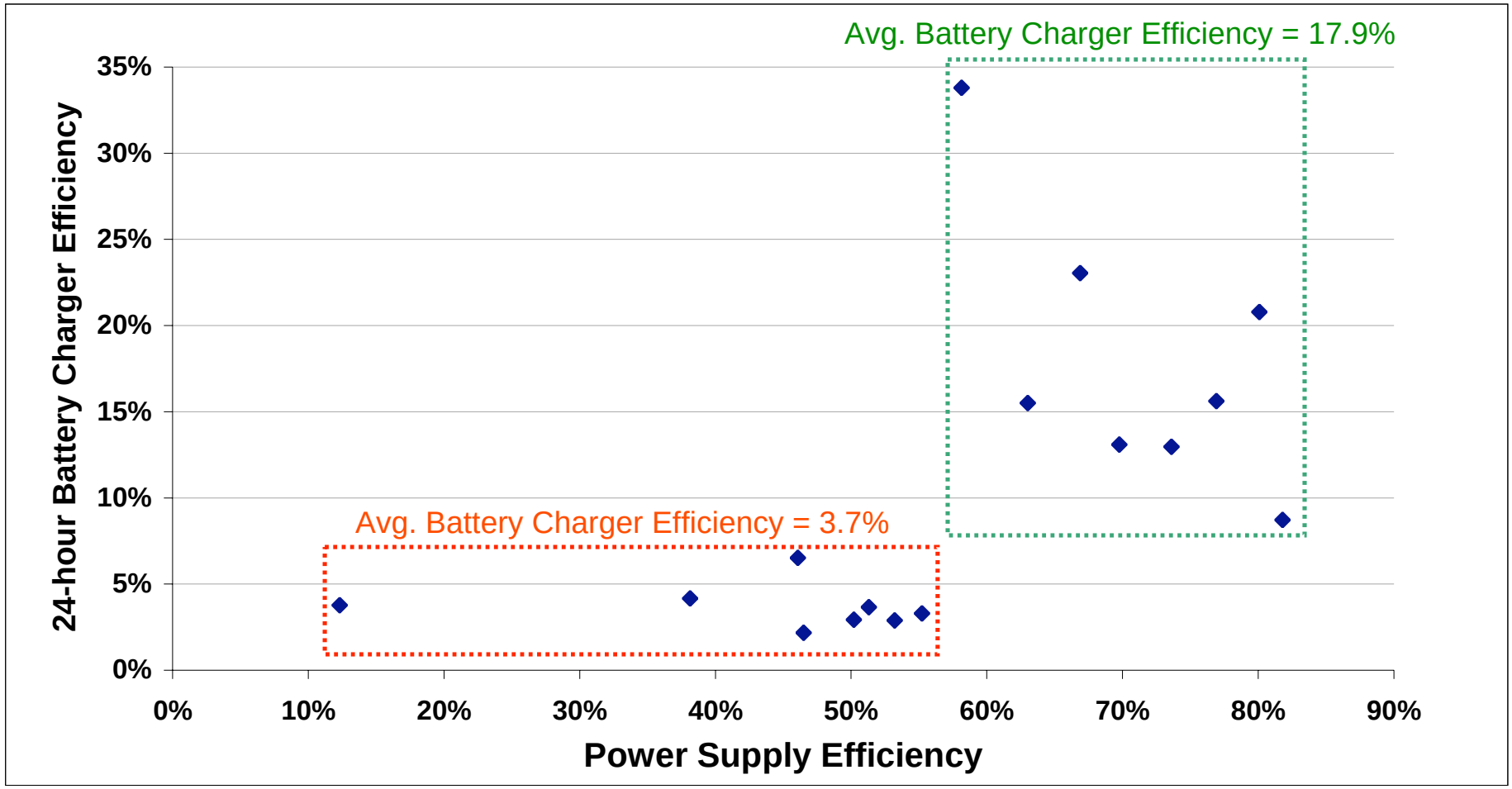
A Look at Power Supply Efficiency During Battery Charging for a Laptop



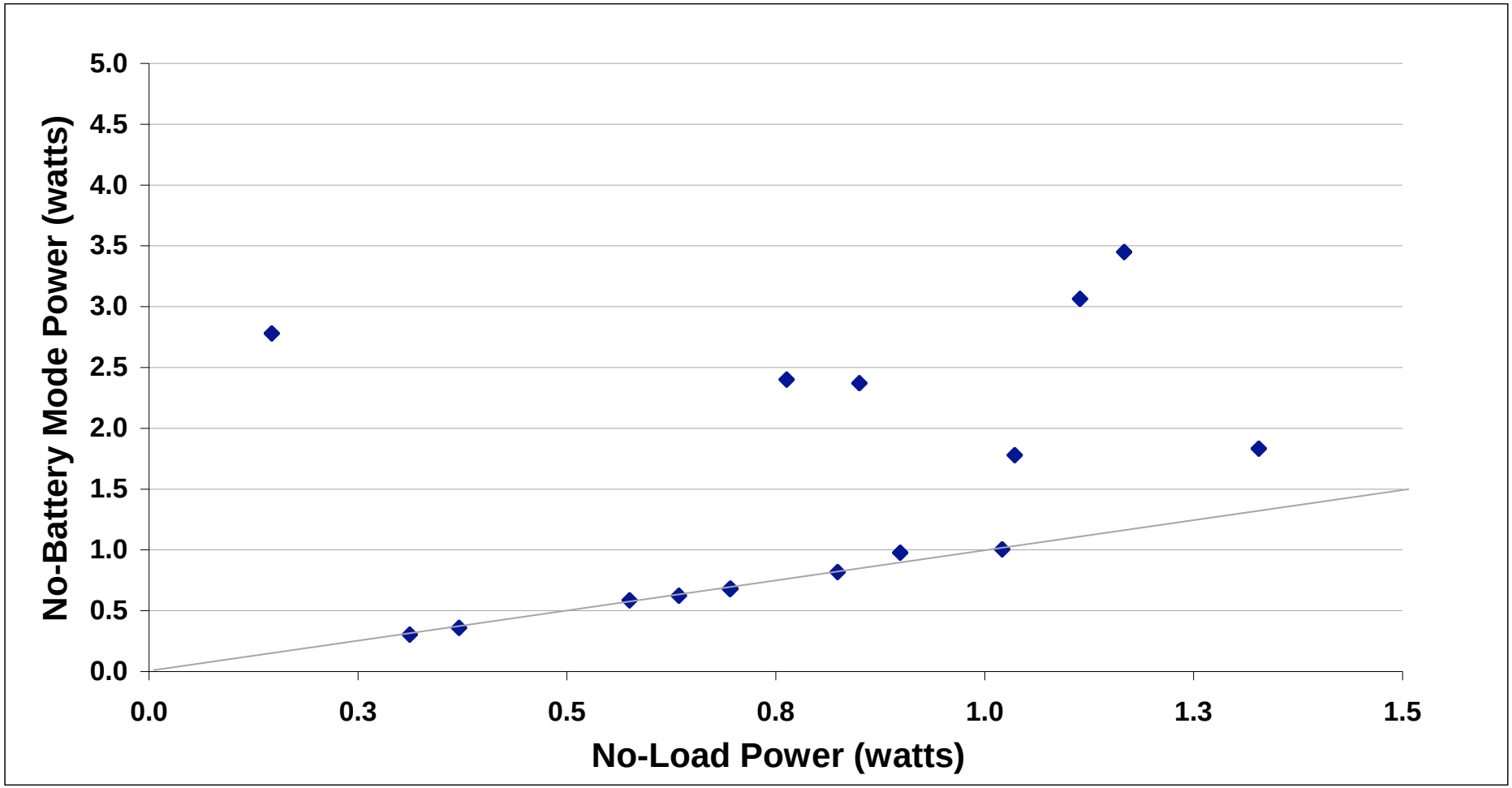
Active (Charging) Mode Is a Vital Consideration to Utilities Because of Peak Loads and Overall Energy Use



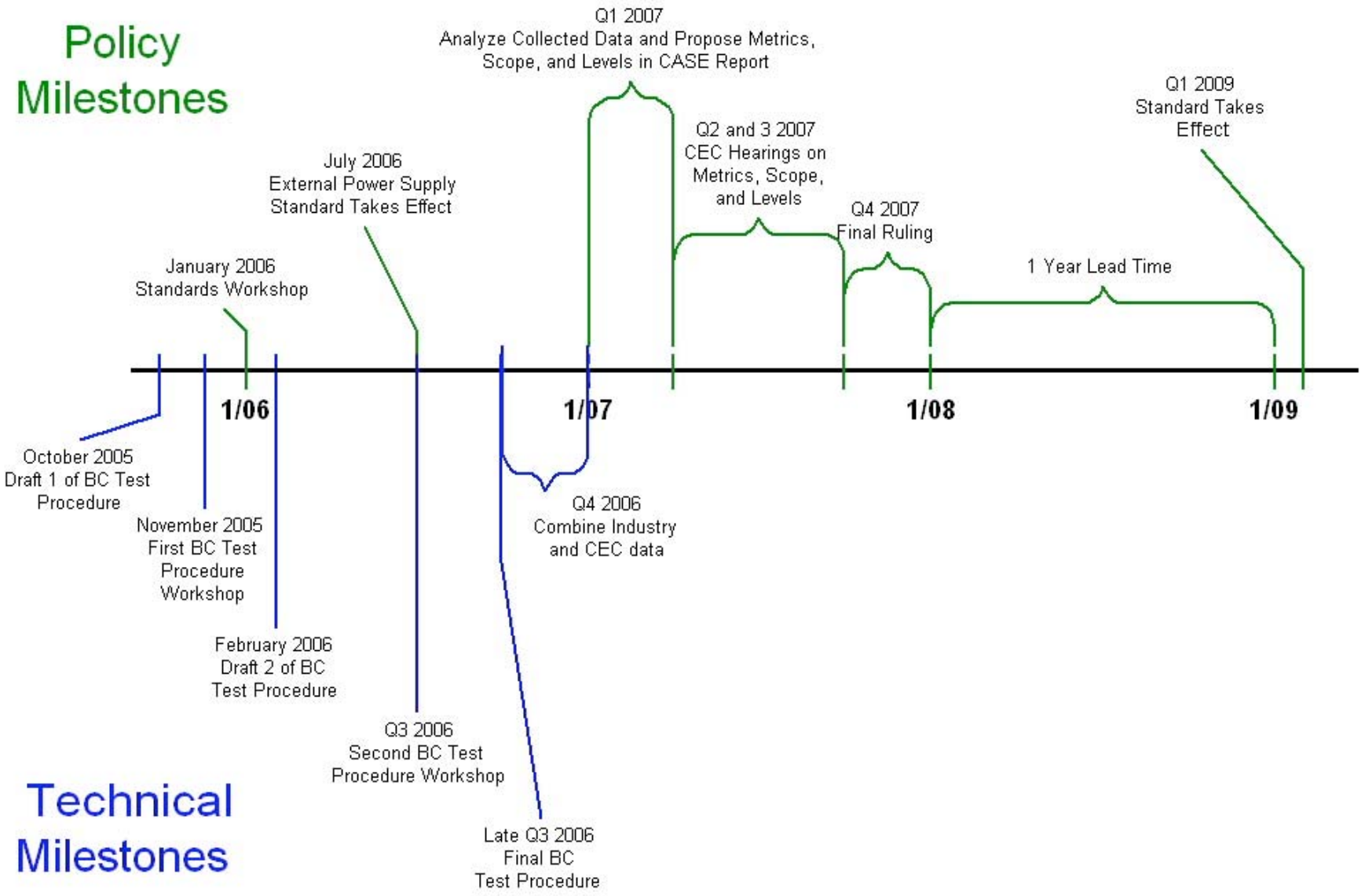
Using a Test Procedure that Includes All Modes of Operation, Battery Chargers with Inefficient External Power Supplies Averaged Less Than 1/4 the Efficiency of Battery Chargers with Efficient Power Supplies



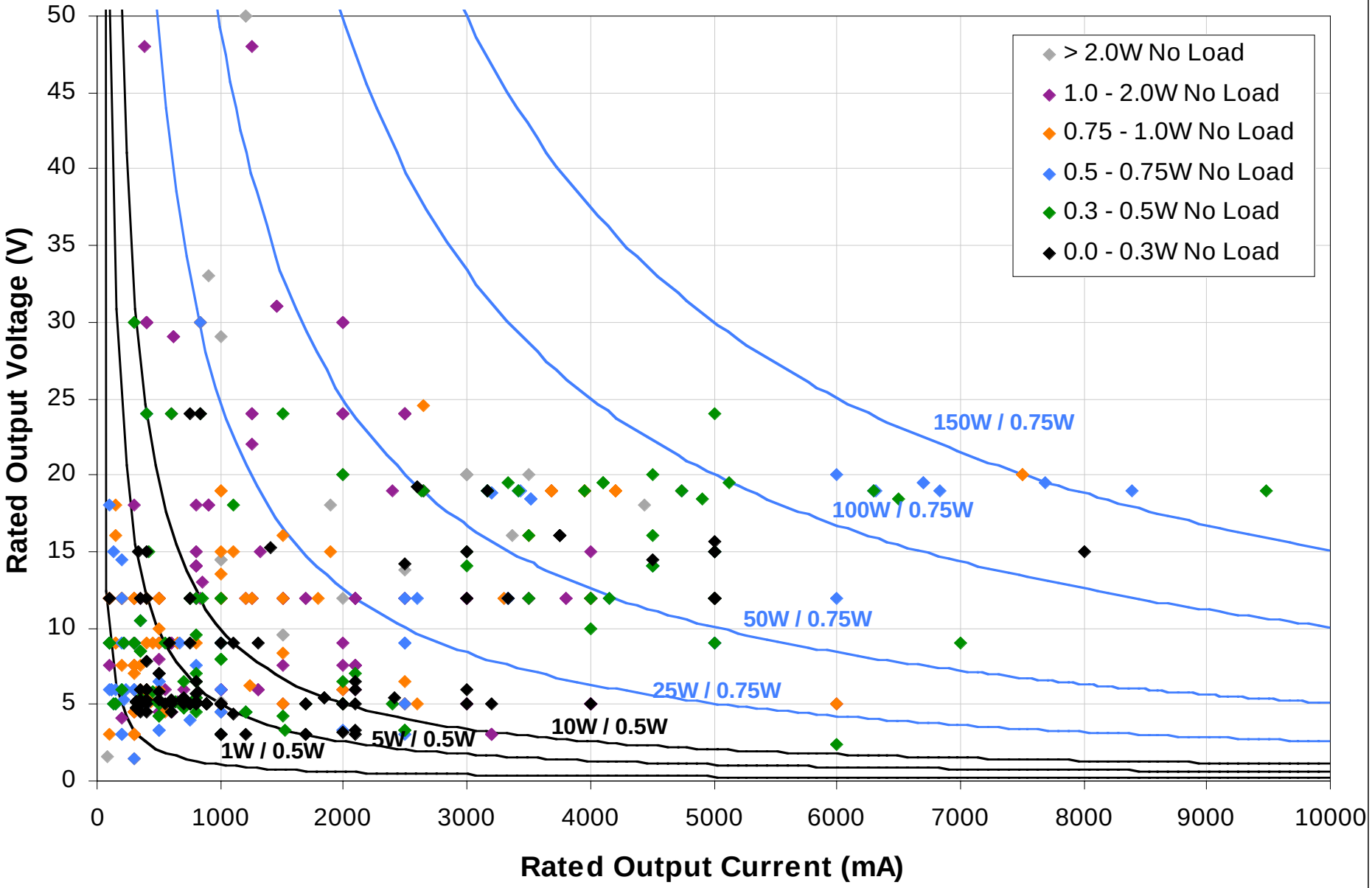
Power Supply Losses Are the First, Most Obvious Source of Losses in No-Battery Mode for Battery Chargers

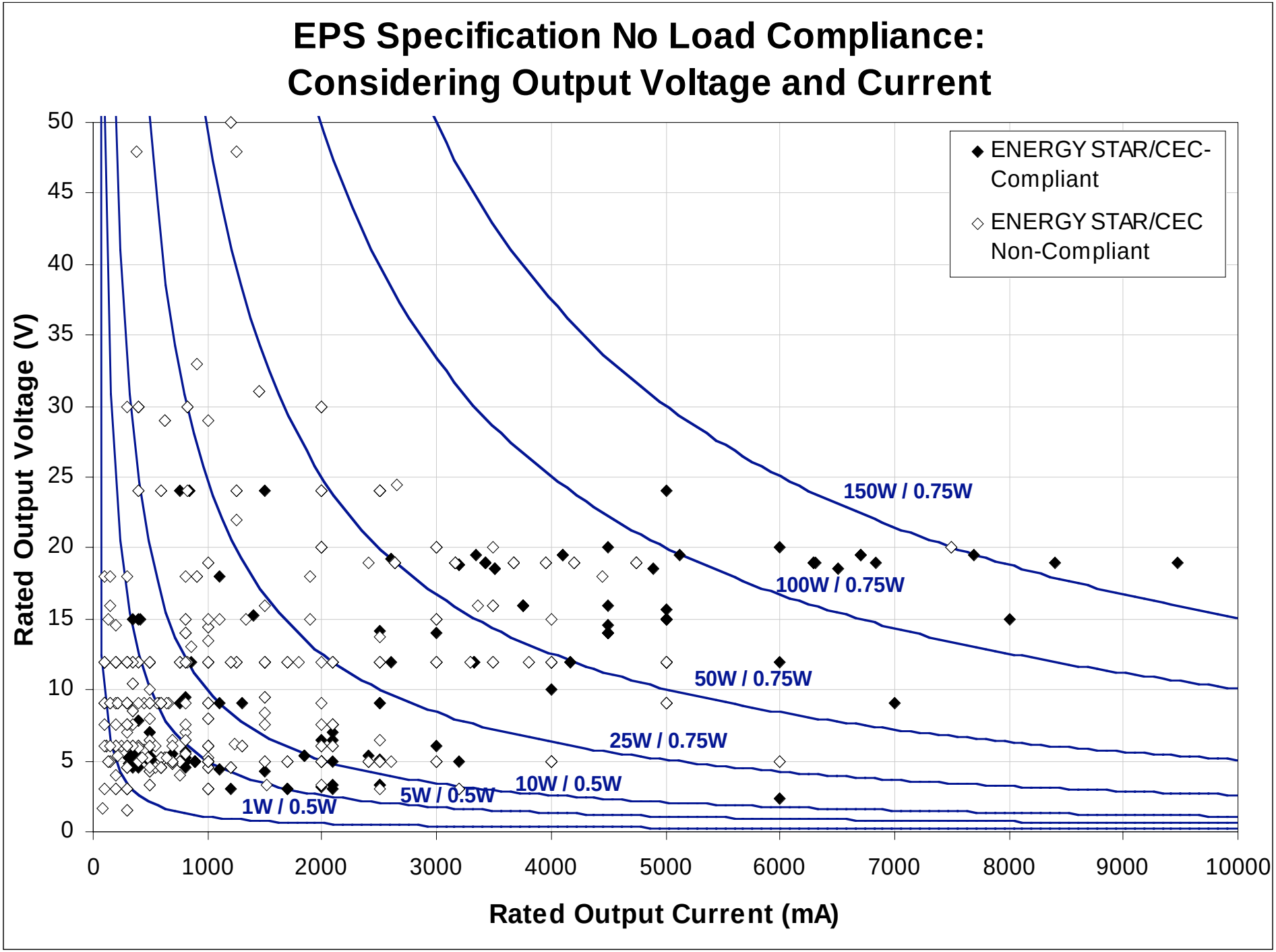


Battery Charger Systems
Policy and Technical Timeline

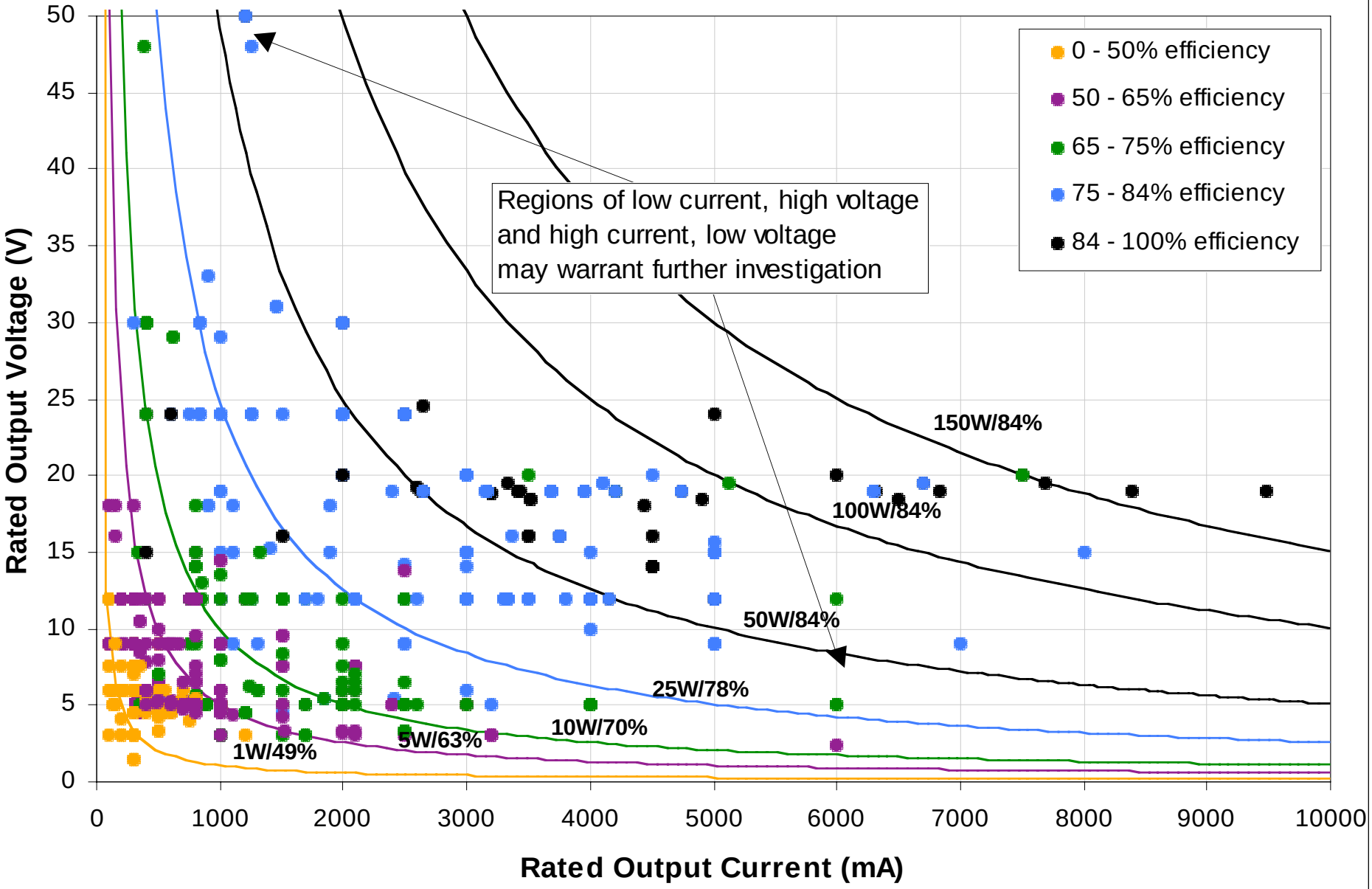


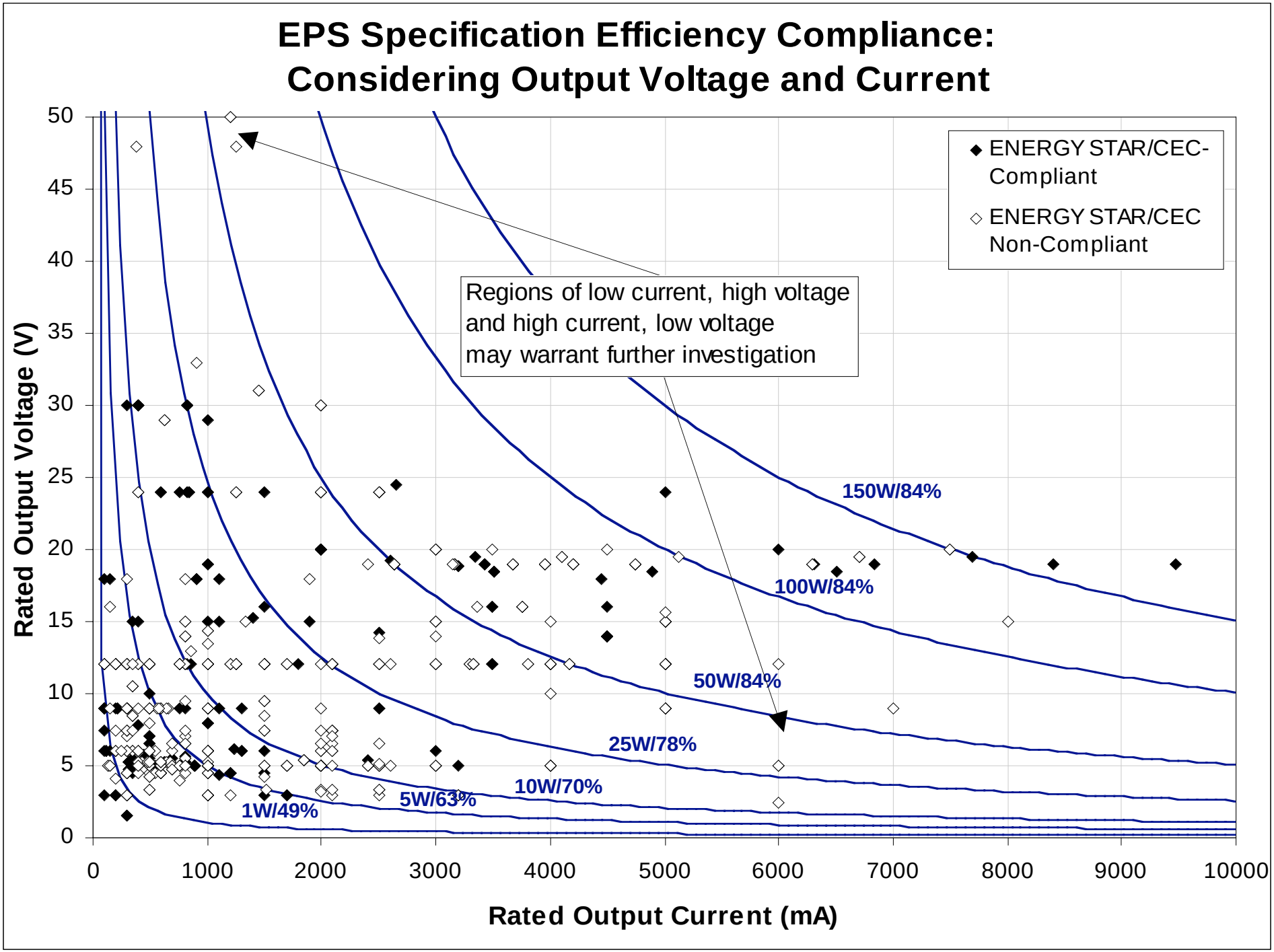
Rated Output Voltage, Current, and No Load Power of External Power Supplies




EPS Specification No Load Compliance:
Considering Output Voltage and Current
Rated Output Voltage (V)
Rated Output Current (mA)
0
5
10
15
20
25
30
35
40
45
50
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
ENERGY STAR/CEC-Compliant
ENERGY STAR/CEC Non-Compliant
150W / 0.75W
100W / 0.75W
50W / 0.75W
25W / 0.75W
10W / 0.5W
5W / 0.5W
1W / 0.5W

Rated Output Voltage, Current, and Efficiency of External Power Supplies




EPS Specification Efficiency Compliance:
Considering Output Voltage and Current
Rated Output Voltage (V)
Rated Output Current (mA)
0
5
10
15
20
25
30
35
40
45
50
0
1000
2000
3000
4000
5000
6000
7000
8000
9000
10000
ENERGY STAR/CEC-Compliant
ENERGY STAR/CEC Non-Compliant
Regions of low current, high voltage and high current, low voltage may warrant further investigation
150W/84%
100W/84%
50W/84%
25W/78%
10W/70%
5W/63%
1W/49%

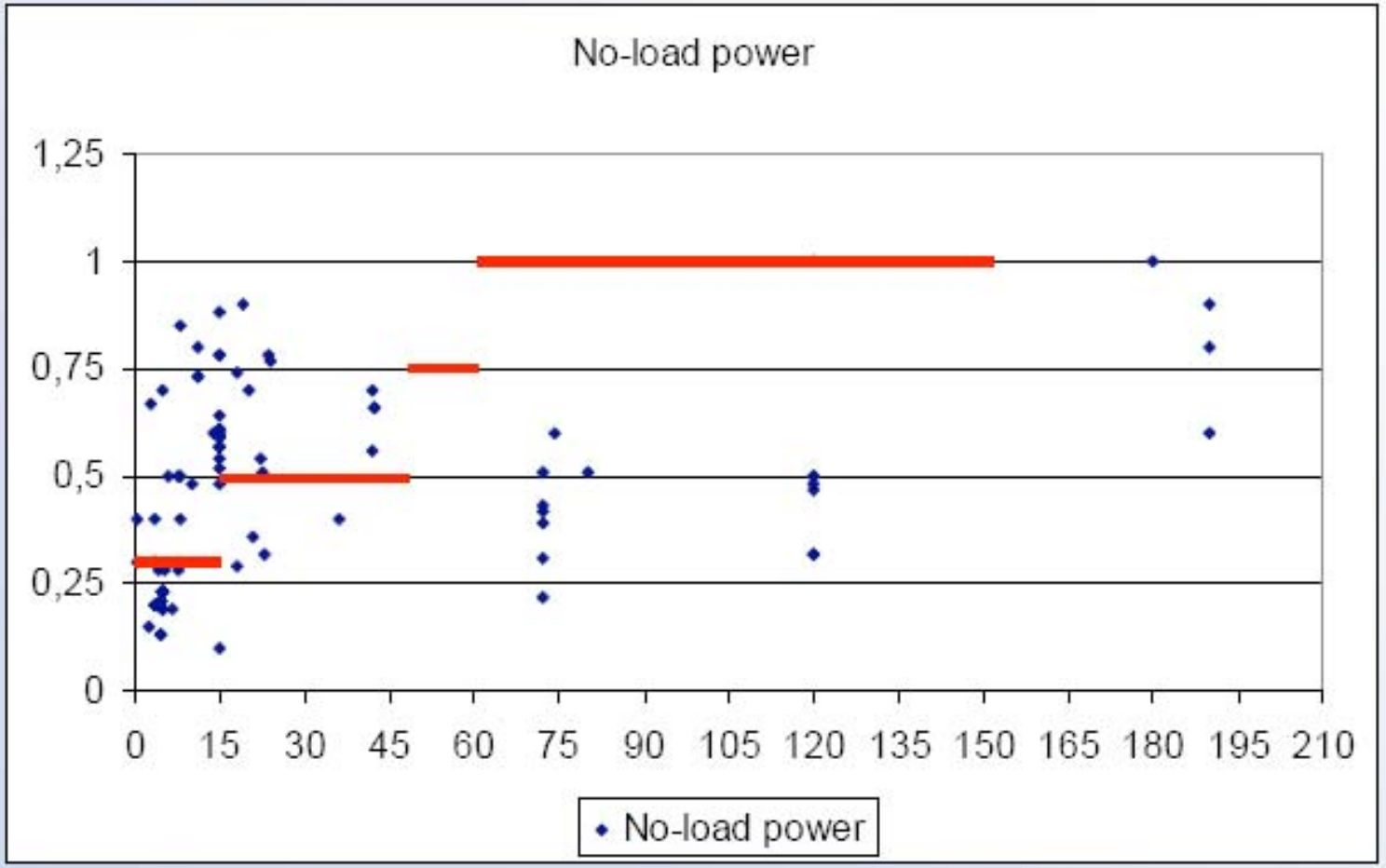
Code of Conduct on Power Supplies
Results 2004

Hans-Paul Siderius

25 May 2005
JRC - Ispra

SenterNovem

Results



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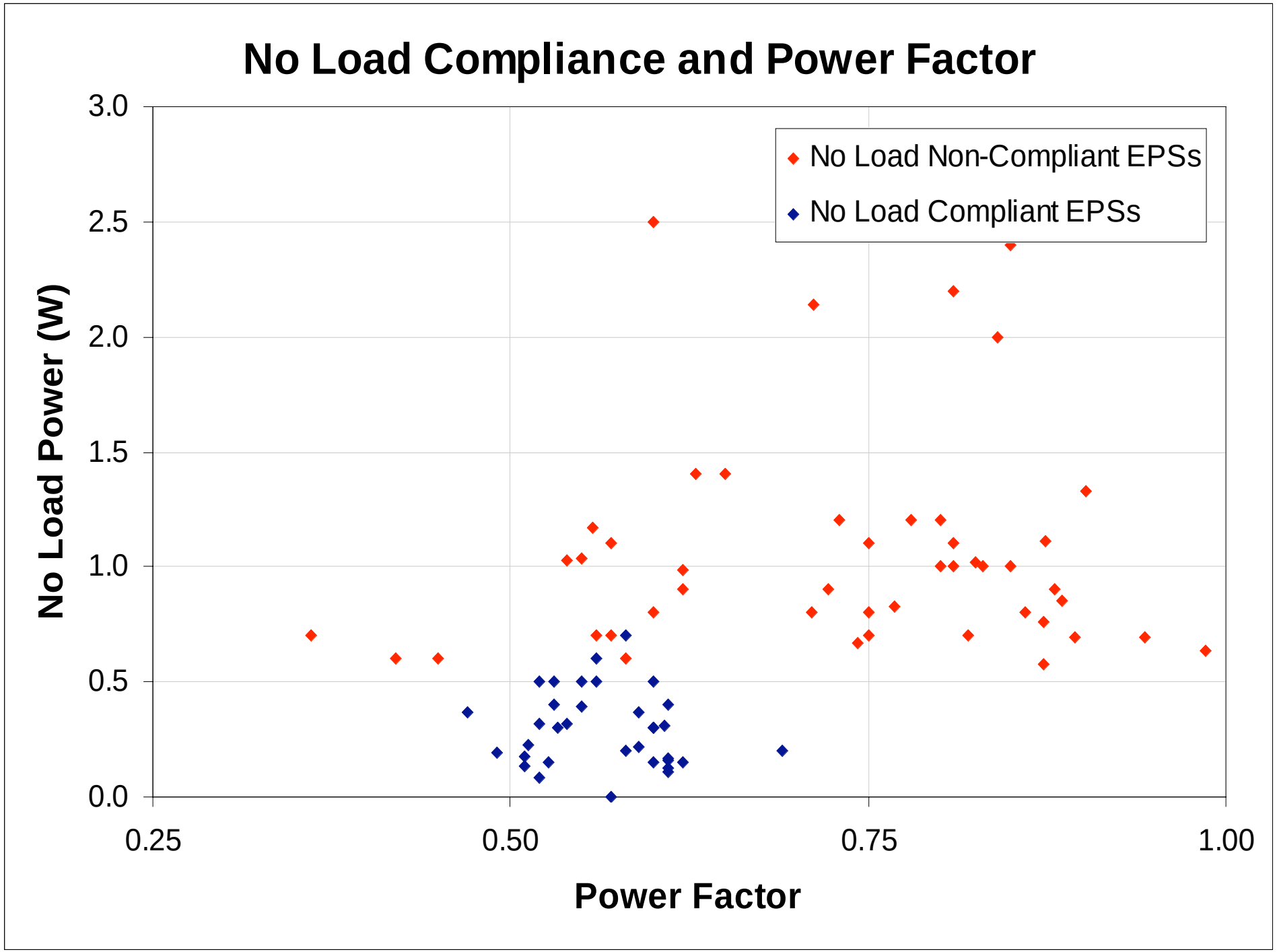
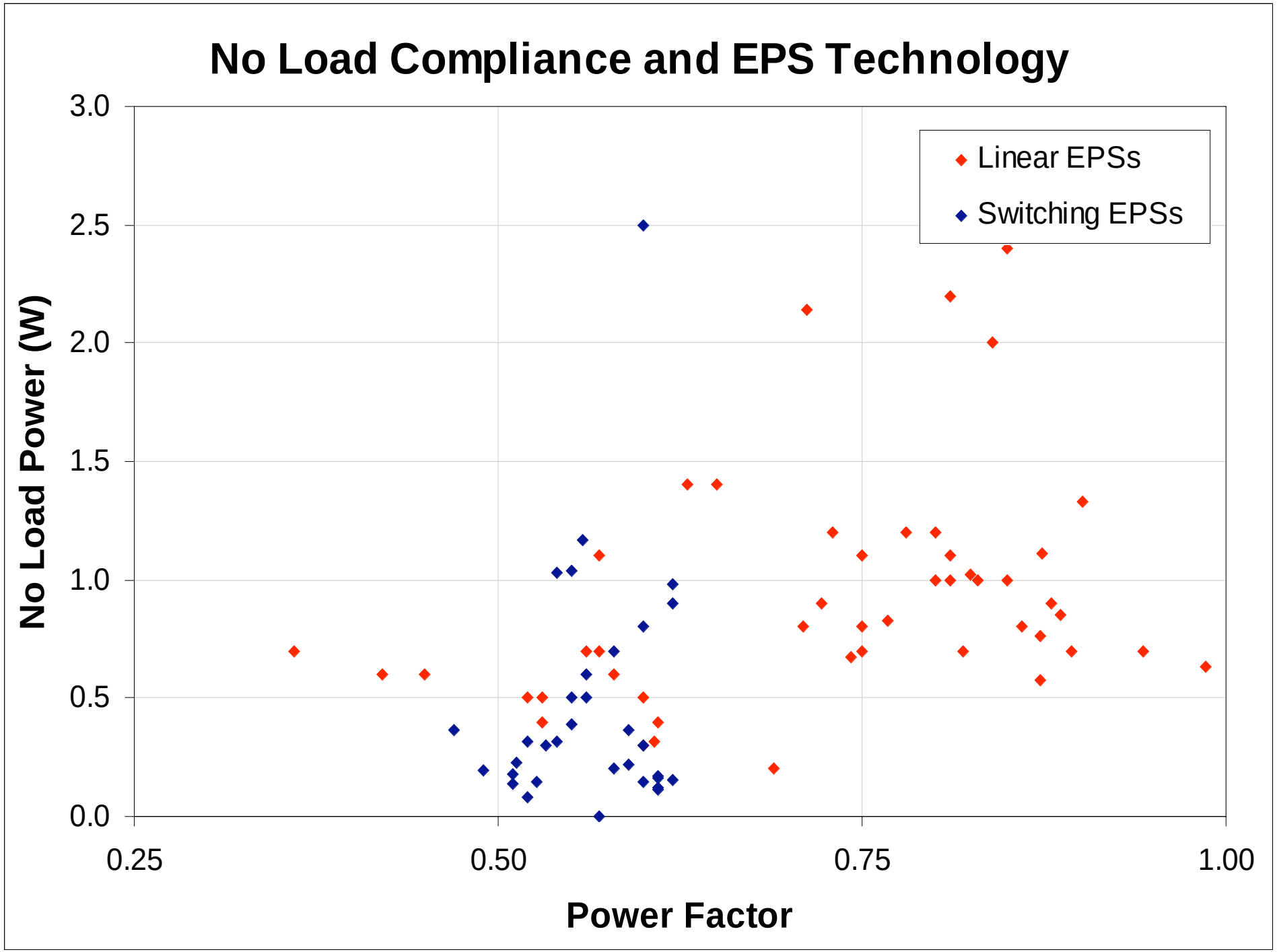
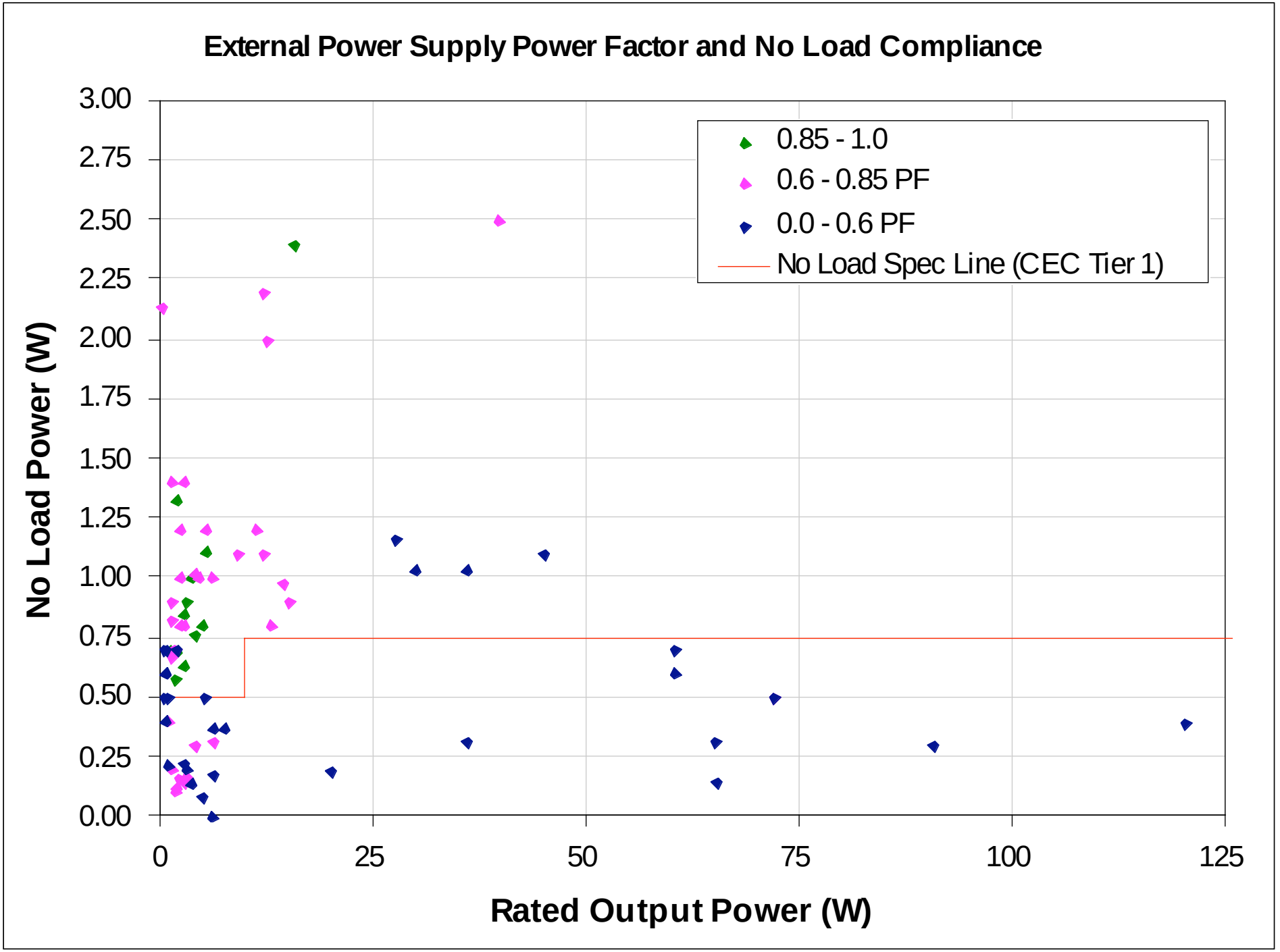
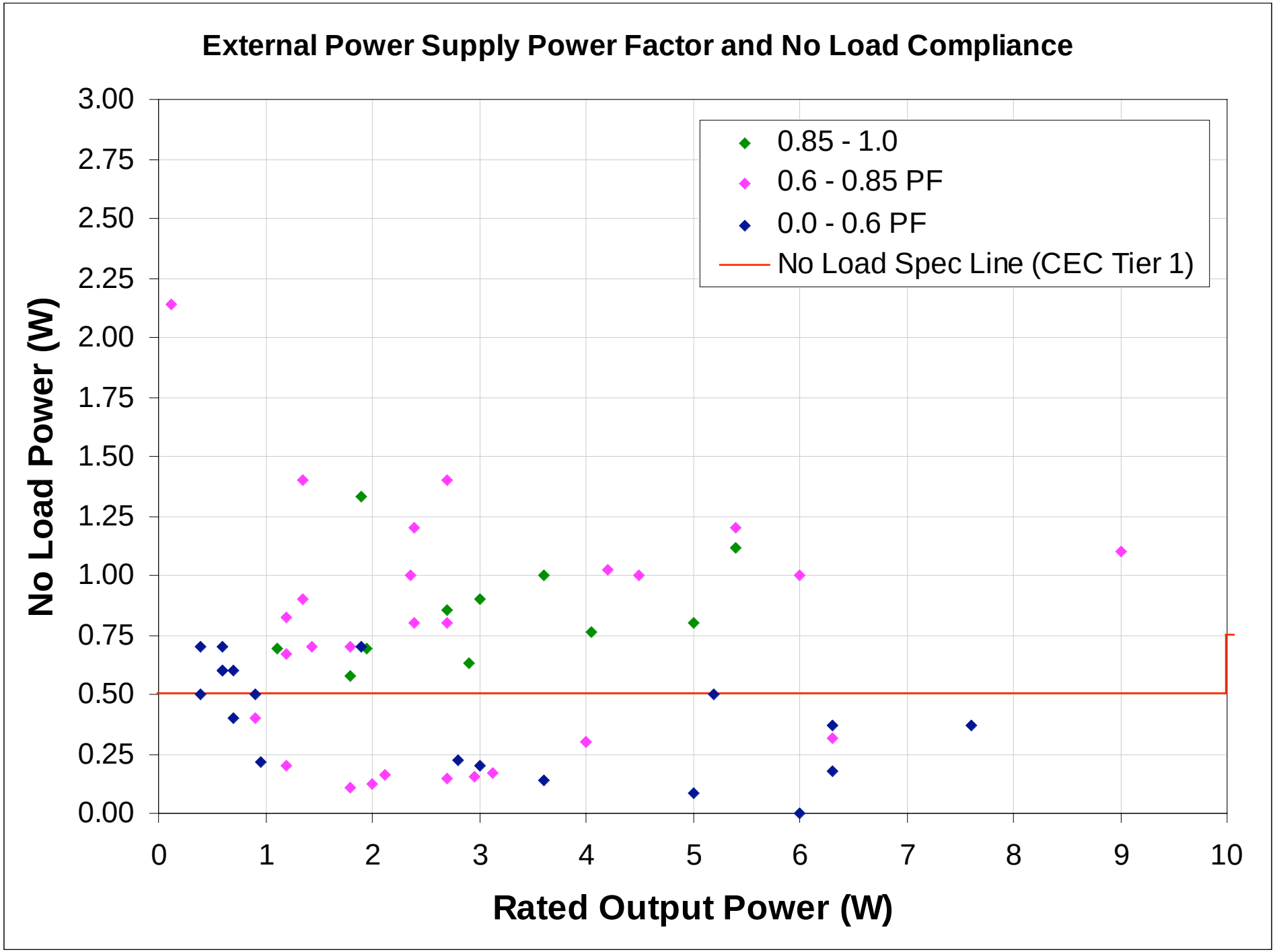
Results

Category	number of models	average no-load power	% complying (2005 level)
[0.3 W - 15 W)	60	0.41	52
[15 W - 50 W)	17	0.79	24
[50 W - 60 W)	0	NA	NA
[60 W - 150 W)	15	0.47	100


No Load Compliance and Power Factor
No Load Power (W)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0.25
0.50
0.75
1.00
Power Factor
No Load Non-Compliant EPSs
No Load Compliant EPSs


No Load Compliance and EPS Technology
3.0
2.5
2.0
1.5
1.0
0.5
0.0
No Load Power (W)
0.25
0.50
0.75
1.00
Power Factor
Linear EPSs
Switching EPSs


External Power Supply Power Factor and No Load Compliance
No Load Power (W)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
25
50
75
100
125
Rated Output Power (W)
0.85 - 1.0
0.6 - 0.85 PF
0.0 - 0.6 PF
No Load Spec Line (CEC Tier 1)


External Power Supply Power Factor and No Load Compliance
No Load Power (W)
Rated Output Power (W)
0.85 - 1.0
0.6 - 0.85 PF
0.0 - 0.6 PF
No Load Spec Line (CEC Tier 1)
3.00
2.75
2.50
2.25
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
0
1
2
3
4
5
6
7
8
9
10

Low Leakage Medical Power Supplies

Jerome Industries specializes in ultra low leakage power supplies for demanding medical applications. All Jerome switchmode products are designed to be useable in a type B or BF medical application, where the power supply provides the sole isolation barrier. Please note, that in the following table where the power supply leakage current is referred to as "Output", the 60601-1 document refers to this as "Patient" .

For the purposes of leakage current performance analysis, switchmode power products may be divided into four categories as follows:

Design Category	Generalized Description	60601-1 Compliance Limits, Normal Condition	60601-1 Compliance Limits, Single Fault Condition
ALPHA	This category represents the minimum requirement for safety certification of a power adapter. Only the earth leakage current is taken into account during the design of the power supply. By ignoring other possible useage scenario's, a slightly simpler power supply design is realized.	Earth Leakage: 500uA (US Deviation under UL specs is 300uA.)	Earth Leakage: 1000uA Single fault condition is a open line or neutral connection.
BETA	All standard Jerome switchmode power adapters meet this category. The output isolation of the adapter will meet the type B and BF leakage current categories from 60601-1. This leakage current data is available on our web spec pages. Link to standard Jerome Switchmode Products:	Earth: Same as above Output: 100uA	Earth: Same as above Output: 500uA Worst single fault is open earth connection. (US Deviation under UL specs is 300uA.) Type BF also requires less than 5000uA leakage with mains voltage applied directly to output.
GAMMA	Switchmode products designed to this category, will meet the type CF output isolation requirements. To meet this category, it is necessary for us to modify the design and construction of the power supply. A small part of our product line has been tested and qualified to these ultra low leakge current requirements. Link to type CF Jerome Switchmode Products:	Earth: Same as above Output: 10uA	Earth: Same as above Output: 50uA Worst single fault is open earth connection. Also requires less than 50uA leakage with mains voltage applied directly to output.
DELTA	This category represents the lowest level of leakage current switchmode products which Jerome presently produces.In addition to meeting the stringent type CF leakage current requirements, these supplies can additionally provide extremely low leakage current levels with any probable input fault condition such as open ground connection, or reversed line and neutral connections.	Note: Delta leakage levels are much lower than 601 CF leakage levels Earth:100uA Output: 3uA	Earth: 100uA Output: 3uA Open earth, or reversed line and neutral connections. Also will measure less than 30uA leakage with mains voltage applied directly to output.

Ultra low leakage current products which meet the Gamma or Delta level leakage current limits, are specialized to the point where certain product specifications may need to be relaxed from the standard product line performance levels. Please contact the Jerome sales department at 908-353-5700 with your exact specs in order to determine product line match with your application.

Special non-recurring engineering fees will apply for the Gamma and Delta product families which will generally be divided into: analysis, design, PCB/mechanical design phase, leakage testing, EMC testing, and safety regulatory submission. Delta products will generally have a higher design fee, and lead time than the Gamma products. The Jerome engineering department should be contacted through the sales department, and can give immedicate technical support. Responses regarding time and cost of NRE development phase are should be available within 24 hours normally.

2005 Cordless Phone EPS Efficiency Data

Phone	AC Power (watts)	Rated PS Output Power (watts)	Average PS Efficiency	Improved PS Average Efficiency
A	2.6	1.9	35%	54%
B	2.9	1.4	40%	58%
C	3.4	2.7	50%	58%
D	5.0	5.4	55%	64%
E	3.4	4.0	56%	61%
Average	3.5		47%	59%

- Average improved PS saves 0.75 W, or 33 kWh (~$4 to $5 at current electric rates) over 5-year product lifetime
- About 25 to 30 million units in use in California
- Savings potential: about 800 million to 1 billion kWh worth about $100 to $130 million over 5-year product lifetime

A Dry Cleaner's Motto…

A lack of preparation on your part does not necessarily constitute an emergency on my part

Hiring lobbyists and lawyers to fight an already adopted standard *does not* constitute timely and diligent preparation for its deadlines.

Hiring engineers, redesigning products, interviewing new suppliers, and issuing new bids to vendors *does*.